

Lessons from Cities Considering Congestion Pricing

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June 2022

Technical Report Documentation Page

1. Report No. UC-ITS-2021-57	2. Government Accession No. N/A	3. Recipient's Catalog No. N/A	
4. Title and Subtitle Lessons from Cities Considering Congestion Pricing		5. Report Date June 2022	
		6. Performing Organization Code ITS-Davis	
7. Author(s) Jonathan P. Colner, https://orcid.org/0000-0001-8633-2839 Mollie Cohen D'Agostino, https://orcid.org/0000-0002-3689-9471		8. Performing Organization Report No. UCD-ITS-RR-22-06	
9. Performing Organization Name and Address Institute of Transportation Studies, Davis 1605 Tilia Street Davis, Ca 95616		10. Work Unit No. N/A	
		11. Contract or Grant No. UC-ITS-2021-57	
12. Sponsoring Agency Name and Address The University of California Institute of Transportation Studies www.ucits.org		13. Type of Report and Period Covered Final White Paper (October 2020 – September 2021)	
		14. Sponsoring Agency Code UC ITS	
15. Supplementary Notes DOI:10.7922/G2WQ0247			
16. Abstract Congestion pricing (CP) is widely considered to have significant potential for effectively reducing vehicle miles traveled, reducing emissions, and providing a reliable revenue source for transportation investments. This study evaluated cities interested in CP—five in the U.S. (Boston, Los Angeles, New York, San Francisco, Seattle) and two in other countries (Vancouver, Canada, and Auckland, New Zealand). This study examines the following features of a CP system for each of these cities: 1) duration of CP investigations, 2) equity mitigations, 3) range of alternatives considered, 4) public engagement, and 5) importance of emissions reductions. Timelines are impossible to predict with certainty, but New York and Auckland appear closest to implementation. Vancouver, San Francisco, and Seattle are well into the process; and Boston and Los Angeles are early in the process. Other key findings include that most of the cities start considering a range of options before narrowing down to comparing more detailed CP systems. Vancouver and San Francisco have made public engagement a cornerstone of their plan development, using polls and workshops to finetune the details of their CP proposals. In contrast, Auckland, while still engaging with stakeholders and experts for guidance, has mainly focused on how to ensure public support and understanding of the proposals they recommend. In terms of equity, discounts are a common and primary strategy proposed among the cities, but some also develop a more comprehensive set of equity policies to accompany a CP system.			
17. Key Words Congestion pricing, vehicle miles of travel, exhaust emissions, social equity, policy analysis, case studies		18. Distribution Statement No restrictions.	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages 31	21. Price N/A

Form Dot F 1700.7 (8-72)

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Acknowledgments

This study was made possible through funding received by the University of California Institute of Transportation Studies from the State of California through the Public Transportation Account and the Road Repair and Accountability Act of 2017 (Senate Bill 1). The authors would like to thank the State of California for its support of university-based research, and especially for the funding received for this project.

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June 2022

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Glossary

Acronym	Definition
CP	congestion pricing
EA	Environmental Assessment
FFFZ	fossil fuel free zone
LADP	Los Angeles Department of Water and Power
LEZ	low emission zone
MPIC	Mobility Planning Independent Commission
ORCA	One Regional Card for All
SCAG	Southern California Association of Governments
VMT	vehicle miles traveled
ZEV	zero-emissions vehicle

Executive

Summary

Executive Summary

Congestion pricing (CP) is widely considered to have significant potential for effectively reducing vehicle miles traveled (VMT), reducing emissions, and providing a reliable revenue source for transportation investments. Cities such as Singapore, London, and Stockholm have successfully implemented CP systems. This study evaluated many of the US cities interested in CP (Boston, Los Angeles, New York, San Francisco, Seattle) as well as some international cities considering CP (Vancouver, Canada, and Auckland, New Zealand). These seven cities are at vastly different stages in the development of CP systems and are employing a range of development strategies, but they also share many features of how they are approaching tailoring CP to fit the needs of their region. This paper evaluates cities along several key metrics, including 1) duration of CP investigations, 2) equity mitigations, 3) range of alternatives considered, 4) public engagement, and 5) environmental considerations, as summarized below.

Duration of Congestion Pricing Consideration Activities

Among the seven cities in this study, New York is the only one to have officially approved a CP plan, however several other cities have produced detailed plans and suggestions for implementation. Auckland began investigating CP over 15 years ago. New York City and San Francisco also began conducting CP investigatory activities over a decade ago. New York City is probably the closest to implementation, but there is no linear pathway towards CP adoption, so other cities could conceivably leapfrog New York, which is expected to complete their final CP planning step, a federally required environmental assessment, in 2023. The most recent city to jump into the fray is Boston, who is in the earliest stages of CP investigation, which began in 2019.

This white paper evaluates cities as they are considering how to build effective CP systems. Assessing plans at different stages and in different contexts will help draw out similarities as well as how those similarities have helped or hindered each city's push to implement a CP system.

Equity Considerations

A core focus of this white paper is to assess whether cities are considering strategies to mitigate fairness issues and seeking to develop equitable CP systems. Our analysis makes clear that all seven cities considered equity and fairness as core elements of a successful CP system, and they are concerned about how low-income and vulnerable populations will fare under a CP system. While some reports have considered a range of mitigation measures, others have focused on pricing discounts alone.

Range of Options Considered

CP encompasses a range of policy solutions and can be implemented in a variety of ways. Some cities considering CP began by examining these different types of CP, while others started with a broader range of options. The cities that are focused on CP systems are among those that have been researching the topic the longest, indicating that they perhaps have already examined the wider range of tools and, similar to the other cities, concluded a CP strategy was preferred.

Public Engagement

While all investigations of CP systems have acknowledged the importance of public engagement, the actual level of engagement varies.

Environmental Considerations

Congestion pricing is primarily concerned with reducing congestion, or flattening peak traffic levels, however these systems can also result in mode switching that results in a reduction in VMT and emissions. The attention to the reduction in emissions varies across cities, with some considering plans more similar to Low Emission Zones if emissions are the main objective, and others acknowledging that exemptions based on emissions would be damaging to the primary traffic goals of any CP system. U.S. cities closest to implementation have widely dismissed structuring a CP system with emissions reduction as a primary goal, however all of them have acknowledged emissions reductions as a benefit and included emissions metrics as key indicators of performance.

Contents

Introduction

This white paper focuses on congestion pricing (CP), which we define as zone-based or cordon charges that impose “either variable or fixed charges to drive within or into a congested area” [1]. Today, cordon charges are mainly used to relieve congestion in dense urban spaces, especially city centers. As with high-occupancy toll (HOT) lanes, implementation of zone-based charges often requires establishing the boundaries of a given zone and installing mechanisms to charge vehicles passing through the boundaries.

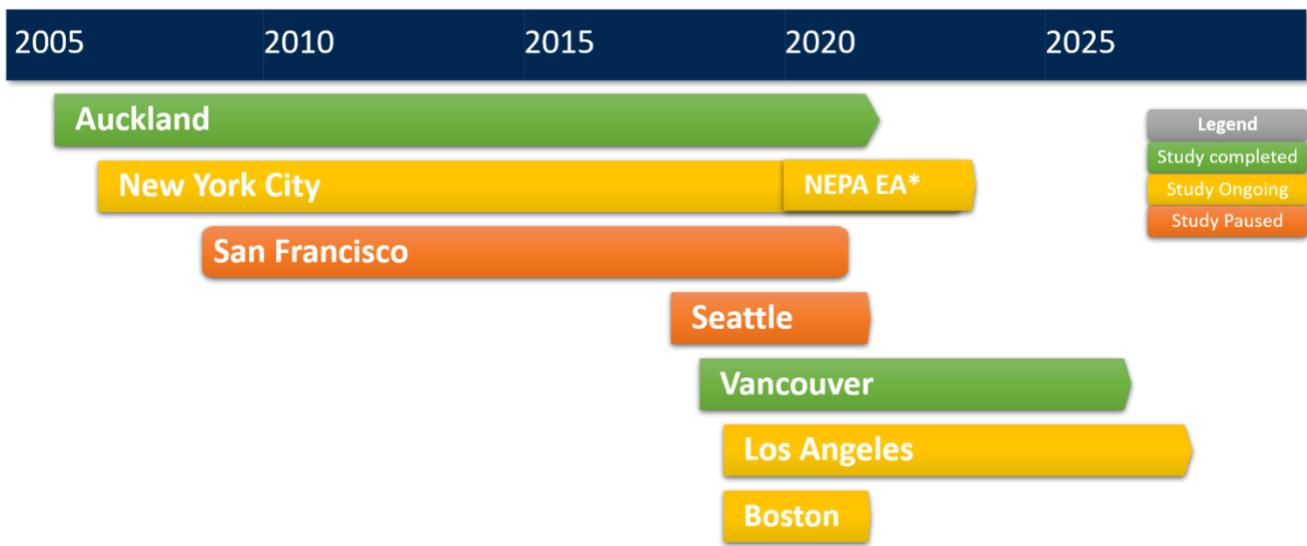
CP is widely considered to have significant potential for effectively reducing vehicle miles traveled (VMT), reducing emissions, and providing a reliable revenue source for transportation investments. Cities such as Singapore, London, and Stockholm have successfully implemented CP systems. This study evaluated many of the U.S. cities interested in CP (Boston, Los Angeles, New York, San Francisco, Seattle) as well as some international cities considering CP (Vancouver, Canada, and Auckland, New Zealand). This report expands on a previous white paper by some of the same authors, cataloguing existing cities with CP, entitled [Equitable Congestion Pricing](#). Here the goal is to look beyond the classic case studies.

The cities compared in this report are all at slightly different stages in the development of a feasible CP system. Because of this variation, as well as the lack of successful implementations in North America, first we will introduce each city and provide a snapshot of what they have done to investigate, legislate, or implement CP.

While a clear or linear pathway is not set for any of these cities to implement CP. For the cities in the U.S., the federal government recently signaled that congestion relief is a priority. In the Infrastructure Investment and Jobs Act (IIJA) of 2021, CP is a qualifying project type under several programs.[2] This may mark a turning point for U.S. cities and states to move ahead with CP adoption.

Assessing Duration of CP Activities

Assessing the progress made by each city so far reveals a pattern of long study periods and multiple attempts to pass CP systems in one form or another. New York has had multiple CP systems proposed since 2008, while San Francisco and Auckland have been producing proposals since 2010 and 2006, respectively. This should serve as a caution to any claim that CP systems are near implementation in any of the cities currently pursuing them for the first time. The political environment in each of the cities differ significantly and an analysis of these political barriers is outside the scope of this study. However, political roadblocks in Seattle and Vancouver point to long timelines for consideration and no clear timeline for adoption. The pathway to CP implementation in the U.S. does not appear to be linear, and Boston could theoretically leapfrog NYC or San Francisco if they can clear political and institutional barriers.



*New York is completing an environmental assessment, part of the National Environmental Protection Act Requirements

Figure 1. Timeline of Congestion Pricing Activities for Select Cities

Boston

Among the cities in our catalogue, Boston is the most recent to begin to investigate CP. In August, 2019 the Massachusetts Department of Transportation produced a report investigating congestion in the state and potential tools that could be used to mitigate it. CP was one of the major tools promoted by the report above other options, however the report failed to detail specifics of what a CP system could look like in Massachusetts or, more specifically, Boston. While interest in a CP system has been growing, there has yet to

be any official investigation by the City of Boston or any further feasibility studies on more specific CP plans for the state [3].

Los Angeles

Los Angeles also began a formal study effort in 2019, although, as of 2021, the project was still developing. The project, called the *Traffic Reduction Study* will be part of the *28 Initiative*, which looks to implement 28 major projects before the 2028 Olympic games. The LA Metro board began a feasibility study in 2019 to investigate congestion relief through the implementation of a CP system [4]. While LA Metro is investigating congestion pricing, the regional government is also assisting in this effort. The Southern California Association of Governments has also been running feasibility studies on congestion hotspots and proposed a variety of policy tools to alleviate congestion in what have been termed *GoZones*, which could be the cordons that will be a part of a potential CP system [5]. Since Los Angeles is a polycentric city, there may be several *GoZones*, rather than one addressing congestion in Los Angeles's downtown. Even with these feasibility reports completed, CP in Los Angeles is still far from implementation; and the CP implementation strategy cannot be truly assessed until the LA Metro feasibility study is published.

San Francisco

San Francisco also took up the mantle to study CP feasibility in 2019, which was their second attempt. The first study was completed in 2010 [6], and the latest round seeks to update the previous study and provide more community input with a focus on equity and fairness. While San Francisco had plans to publish the report and present it in 2021–2022, the San Francisco County Transportation Authority staff claim that they are pausing this timeline in light of the impacts of COVID-19 on the downtown core. They have released several interim updates to their Policy Advisory Committee [6].

Seattle

In 2019, Seattle completed a CP study [7], thereby completing the investigatory stage. Nonetheless, the fate of CP in the city remains in limbo. In March 2021, Seattle Mayor Jenny Durkan told their local National Public Radio (NPR) station that they are “pivoting the conversation from specifically addressing 'Congestion Pricing' to instead focusing on how best to fund the transition to a more equitable transportation system” [8]. The city's investigatory phase included several high-level analyses to assess the impacts of CP systems and identify a set of potential systems to be analyzed as well as recommended a structure for further assessing any plans. Seattle's report had acknowledged that they were still far from the official development of a program that is ready to be approved. Whether Seattle is still in the exploration stage remains unclear. The report indicated a need to specifically define objectives, and convened an independent commission to begin engaging with stakeholders as steps necessary before a specific system can be developed [7] [9].

Vancouver

Vancouver in Canada is also still in the study phase of *transport pricing*, as they refer to it, but unlike many of the U.S. examples, it has a clearer pathway to implementation. As part of their Climate Emergency Action Plan, Vancouver is developing a CP strategy that, if approved, will be implemented in 2026 [10]. A CP strategy update will be provided to the city council in 2022. While little to none of this report has been released, work done by TransLink, the regional authority responsible for the transportation Network of Vancouver, and their Mobility Pricing Independent Commission, generated recommendations for the city. These recommendations provide insight into what the city's final report could contain.

Auckland

Like San Francisco, this mid-sized city, in New Zealand, has been studying CP for more than 10 years, with their first report finished in 2006. Unlike San Francisco, Auckland's work appears to build more naturally on previous reports rather than starting fresh. The Transport and Infrastructure Committee, which is part of the House of Representatives of New Zealand's national government, published a report in May 2021, opening an "Inquiry into congestion pricing in Auckland." The report identifies community engagement and infrastructure development as the next steps before beginning the approval process [11]. In August 2021, they published another report summarizing the engagement outcomes and recommending strategies for a CP program for the City. It is unclear whether this recommendation will result in near-term approval of a CP system, and Auckland has no official plan for a public vote. However, their work thus far indicates that they have completed outreach efforts and may move forward with the committee's recommendations. In our assessment, Auckland is perhaps the second furthest along among the cities that have not yet received approval for a CP system.

New York City

Of the cities examined, New York City (NYC) is the closest to fully implementing a comprehensive CP system. In February of 2019 congestion fees were implemented for ride-hail services in a section of Manhattan [12], as part of a first phase of the CP implementation. But a broader charge still appears to be stuck in the slow lane. NYC is required to submit an Environmental Assessment (EA) to comply with the National Environmental Policy Act [13]. While the EA typically is a faster process than a full Environmental Impact Statement, estimates are that the EA will conclude in 2023, further delaying the fraught NYC CP roll out. In September and October 2021, the city is conducting hearings to receive public comment about the proposed charge. While the City received council approval to move forward a CP system through the state assembly in 2008, the State blocked it from moving forward at that time [14].

Assessing Equity Considerations in Congestion Pricing Efforts

Equity interventions varied significantly across the cities examined. All cities in this study have considered discounts or tax credits as a means of directly counteracting the CP fee, and many also are considering investments as a mechanism to improve mobility options, e.g., transit, bicycle, and pedestrian infrastructure. Furthermore, CP systems must find an optimal balance of equity and efficiency. Vancouver acknowledges one of the key paradoxes of implementing an equitable CP system: “the lower the charge, the more it can be described as a ‘tax grab’ - only at relatively higher charges do the congestion benefits start to appear” [11]. Vancouver suggests a range of possible fairness metrics, such as assessing fees as a percentage of annual income, in order to identify the amount needed to offset income-burden.

In terms of implementing such a discount, there is some consensus in Vancouver that using existing rebate or voucher programs would be the easiest and most understandable way to apply the discount. However, improving and streamlining the processes related to public benefits discount eligibility remains a challenge that is much larger than a CP program. Vancouver does not have any relevant city-based discount programs in place that are related to transportation, aside from a reduced bus pass program for seniors [15]. Thus, the City would have to look to provincial and national eligibility metrics, or look to newly emerging eligibility mechanisms. Vancouver is currently starting a TransLink low-income fare program.

San Francisco is also focused on a strategy for ensuring an equitable CP system through the use of income-based discounts [6]. Part of the public outreach carried out in the San Francisco feasibility study asked participants to identify and choose between different discount levels and to balance the trade-off between discounts and revenue generation. In San Francisco’s first CP report, conducted in 2010, the City stated that income-based discounts are a key element of ensuring equity in the system. The 2010 report suggested aligning the discount with San Francisco’s Lifeline Program. This program offers a 50% discount on a monthly transit pass for individuals making less than 200% of the federal poverty level [16]. The San Francisco study is not complete, nonetheless Figure 2 shows the discounts proposed, with very low-income drivers receiving a full refund [6].



Figure 2. Income-Based Congestion Charge Discounts proposed for Los Angeles and San Francisco. Note: The current income caps are more stringent than previous programs and are revised to the following: Very low-income (< 55% Area Median Income [AMI]), low-income (> 88% AMI), moderate income (< 120% AMI).

In terms of assessing eligibility, the existing Lifeline program may offer a possible choice, given there is already an established protocol to assess income status for the lowest income group under this system, and thus implementing a stepped discount system would not necessarily require a new program, but simply an expansion of current eligibility protocols.

LA Metro’s CP study is similarly focused on discounts as a possible way to improve CP system fairness. However, their effort is still in the early stages. An introductory discussion of equity impacts and mitigation strategies that cover a CP system in the Los Angeles region was included in the Southern California Association of Governments’ (SCAG) mobility Go Zones report.[17] SCAG’s report, much like the CP reports in other cities, pays close attention to potential equity impacts and considers ways to counteract an imbalance. SCAG suggests that only 8% of all daily trips in the Go Zone would involve low income drivers, it suggests a 50% discount for low income drivers and a 90% discount for low income residents within the zone would not impact the effectiveness of the charge.

Furthermore, the report closely examines a range of current programs that could be used to identify the population that would be eligible for the discounts, including LA Metro’s Express Lanes program that provides a \$25 discount towards using the express lanes for households making less than 200% of the federal poverty level [17].

Another potential program that could be used is provided by the Los Angeles Department of Water and Power (LADWP). The LADWP is a discount program offered to low income residents, however while 37.3% of users are eligible, only 42% of low-income residents are enrolled. This hints at one of the reasons for connecting any discount program to a current policy. Making the discount easy to access and understand is critical to ensuring that everyone who needs it is able to get it. The final program that is proposed by the study is the Southern California Gas's California Alternate Rates for Energy (CARE) program.[18] This program offers a \$15 service establishment credit and a 20% discount on monthly rates. The SCAG report clearly identifies connecting any discount program to an already existing program as the best way to ensure access [17]. While all three of these programs have been proposed, no single one is recommended as the best option. Going forward, the strong focus on potential programs would indicate that Los Angeles is likely to have a discount focused mitigation strategy that is linked to an already existing program.

While the three cities above are the only ones that have concretely listed specific discounts, Auckland, Seattle, and New York include some mention of discounts in their discussion of the possible suite of mitigation strategies that decision-makers could consider. Auckland's research into the equity impacts of CP systems are the most comprehensive across the cities being studied, with several full reports considering these impacts [19], [20]. Most of the equity strategies discussed in the reports from Auckland, Seattle, and New York revolve around discounts, but the reasoning behind the discounts differs among the cities. Also, Auckland, unlike Seattle and New York, discusses the need for a range of mitigation tools in addition to discounts. However, in its reports, Auckland does not consider or describe these additional tools at the same level of detail that they discuss discounts.

Auckland's report indicates a hesitation to rely too heavily on discounts and exemptions as they can drastically reduce the effectiveness of the CP system. Instead they support an extremely targeted discount program. With this in mind, the report suggests using the Community Services Card to identify the population that would be eligible. This group is the size desired, approximately 10% of the population, and includes various income levels for different household sizes [21].

Another potential program in Auckland is the Total Mobility system, which offers a 50% discount for individuals with permanent, temporary, or fluctuating disabilities [22]. While this would be less focused on low-income users, it is another program that could be used to ensure various vulnerable households are not unduly affected by a CP system.

Seattle's mitigation strategy appears to be the widest ranging of the strategies described by the cities studied here. While one of these includes the possibility for a discount program similar to those discussed in other cities, much like the SCAG Go Zone study, the Seattle report also lists improved transit services, carpool programs, and bike lane improvements as ways to ensure an equitable CP system. Thus, while we are likely to see some form of a discount program in Seattle when CP is implemented, it will be only as one part of a larger equity strategy. Even with the broader focus, the report still identifies potential programs that could be used as a starting point for a discount program.

The rider card for several transit systems in and around Seattle, known as ORCA (One Regional Card for All), provides different discounts for low-income, elderly (65+-years-old), and youth (6- to 18-years-old) riders. The first of these, ORCA LIFT, offers discounts for residents making less than 200% of the federal poverty level; the fee for these residents is \$1.50 per trip, whereas the standard adult fee is \$2.25 to \$5.75 per trip (a discount of 33%–74%) [23]. Seattle proposes integrating, with relative ease, these discount programs into a discount program for CP. While Seattle’s research on a CP system is still in its early stages, it’s current published work indicates a strong mitigation strategy involving both a discount program and other policy tools.

Boston is one of the cities that has yet to explore the range of equity impacts of CP or describe related mitigation strategies. The report on congestion largely favors smart tolling over a more simplified cordon system, because the former may offer a favorable discount strategy while the latter could be less equitable. Boston has a program known as the Youth Pass CharlieCard that could be used as the basis for a discount program. The program only involves residents aged 18–25 years, but it offers a low-income, reduced fare for the Massachusetts Bay Transit Authority (MBTA) system [24]. Using this program as the basis of a CP discount system would require significant changes to eligibility, however no other discount system as yet appears better suited for a potential CP system.

While New York is much further along than Boston, it is similarly unclear how it plans to mitigate any equity issues caused by its CP system. As is the case for low-income commuters in the Los Angeles area, a small proportion of low-income commuters in the New York area drive into a central urban district, in this case Lower Manhattan. A 2017 study found that only 4% of “outer-borough working residents” (residents from boroughs other than Manhattan) commute to the cordon zone. As it currently stands, residents within the CP zone who make less than \$60,000 annually will receive a tax credit equal to the cost of the congestion charges [26]. The commission setting the final rules for the system can still add exemptions, thus it is possible that additional discounts will be made available to low income or vulnerable households.

While not mentioned in any of the reports on New York City’s CP system, the city does offer a program known as Fair Fares that offers a reduced monthly transit card (Metrocard) for those making less than \$12,760 in a one-person household. While this program could be used as part of a CP discount, the Fair Fares program has been criticized for being quite a low bar, leaving many lower- and middle-income people who might be adversely affected by the cost of transit still ineligible for the discount [27]. While this program is an option, the City will likely need to use other strategies or programs to offer the discount. The main goals of the CP program are to reduce congestion and raise funds, with significant infrastructure improvements being earmarked for the revenues produced, and this earmarking is likely to improve equity for the majority of low-income New Yorkers who do not drive into Manhattan.

Assessing CP Alternatives or Complementary Policy Options

Though the focus of this study is on CP systems, for all the cities, CP is just one part of a suite of potential tools that they are considering to reach their sustainable transportation goals. In many of the studies we evaluated, CP policies were broadly compared to other ways to reduce congestion or emissions. Seattle and Vancouver started from broad lists of potential systems, and the differences between their initial pairing of supportive policies is illustrative of their city's priorities and goals. They both considered different types of CP systems such as area or cordon pricing, parking pricing systems (such as a parking levy or sales tax), and some sort of toll or arterial lane pricing.

Seattle also considered a Fossil Fuel Free Zone (FFFZ), which is a version of a the more broadly defined low-emission zone (LEZ) [6]. Creating LEZs is a strategy that is often paired with, but can run in conflict to, CP systems. For example, in Milan the emissions based CP system restricted fees to dirtier vehicles, so over time, as fleet turnover yielded cleaner vehicles, congestion returned, although emissions were reduced [28]. When cities treat emissions reductions as equally important as congestion reduction, a careful balancing act is necessary. Seattle appeared to favor a CP system over their FFFZ concept, but both are presented as possible policy alternatives for decision-makers to consider.

Vancouver did not consider LEZs or an FFFZ, however they did consider other options such as a fuel tax. Again, this can be understood partially based on the goals driving their study, namely, supporting transportation investment as well as reducing congestion. The consideration by Seattle and Vancouver of options other than a CP system indicates a bigger focus on revenue generation. In the end these two cities discarded these other options: Seattle narrowed their selection to cordon pricing, area pricing, fleeting pricing, and a road usage charge; and Vancouver narrowed their options to a distance-based charge and a congestion point charge. Although these final options are mainly variations of traditional CP systems, the other options that were considered or the rationale behind considering them will likely continue to play a role in the development of each city's CP systems.

Like Seattle and Vancouver, Boston was not explicitly focused, in their investigation of congestion, on CP systems. Instead, Boston's report compares tolling and smart tolling to a CP system. While the City is not examining a wide range of options like Seattle and Vancouver, they are considering options outside of typical CP systems [29]. Of the cities examined in our current study, Boston is the least advanced in their work on CP, having not yet taken concrete steps to study a CP system. Furthermore, Boston's report is recommending a study of CP systems, not attempting to carry one out. Thus, they are comparing a CP system to tolls because these are an option that is already readily available to the state to implement. The report, rather than comparing potential toll systems to CP systems, enumerates the flaws with attempting to use tolls and smart tolls to manage congestion, suggesting that a true CP system is necessary.

Another city that considered a wide range of options is Auckland. Unlike the other cities considering an expanded set of options, Auckland is relatively advanced in their work on congestion reduction. While Auckland's first report on congestion reduction was in 2006, their most recent report, of 2020, still considers over 25 different options [11]. However, unlike Seattle and Vancouver, Auckland is considering options that are, for the most part, some type of CP system. Rather than narrowing down to a policy type and then investigating different ways to structure it, Auckland's report on congestion reduction considers variations of the same policy type against variations of other policy types. This would seem to indicate that rather than iteratively narrowing from a broad goal to a CP system to a particular variation of the chosen system, Auckland is instead assessing more detailed versions all at once. Thus, while the specificity of the plans considered by Auckland are more similar to the CP system options studied in New York, the range of options more closely resembles that of Vancouver or Seattle.

Los Angeles is different from the other cities here in that it has two separate reports on reducing congestion in the city that appear to have taken different approaches to the range of options considered. The report released by SCAG considers a wide range of tools. Rather than narrowing down to one or two separate policies as in the Vancouver and Seattle reports, SCAG's report provides a suite of options that could be implemented together [17]. This generation of a Go Zone (e.g. a suite of policy strategies to discourage single occupancy car travel in a zone) is thus different from the options explored by the other cities in this study. While the report does focus on the use of congestion fees, the plan presented is treated as a collective set of policies that are implemented together. This is largely motivated by the goal of the report, which was written to identify potential pilot locations to test these different policy systems. While the other cities in this study are considering implementing a wide-sweeping policy to reduce congestion, SCAG's report is focused on the feasibility of a pilot program. The focus on creating an ideal version that includes several policy changes explains why there was less of a narrowing process and why the options considered in this report do not directly compare to the options and decisions made in the reports for other cities. In contrast to SCAG's report, in-process work led by LA Metro focuses exclusively on congestion pricing. Though part of LA's 28 initiative, a CP system involving a cordon model, a VMT model, or a corridor model is being investigated. Until this report is released, it will be difficult to determine the range of options within this subset, as well as how these different options are evaluated. Even still, the two groups working on feasibility reports for congestion reduction strategies in Los Angeles have taken two very different approaches and considered different ranges of options in their reports.

New York City is closest to implementation and is now considering the narrowest range of options. One aspect of the state bill approving a CP system in New York City establishes boundaries of the cordon pricing system, thus narrowing the possible final policies considerably [26]. While the price structure and exemptions are still to be determined, New York has narrowed down to a cordon-based CP system. San Francisco is similarly focused on a CP system, though reflecting its progress it has not settled on clear boundaries. Since 2010, San Francisco has been focused on CP systems, comparing area and cordon pricing to determine the most effective policy [16].

In conclusion, it appears that most cities start with the broader goal of congestion reduction, then narrow their focus to one or two specific policy types, then discuss potential variations of that type. Thus, cities like San

Francisco and New York, who have spent more time investigating congestion pricing, have advanced to examining variations of a CP system, while cities like Vancouver and Seattle are still evaluating a wider range of policy tools. The exception to this is Auckland, which has kept the range of policy tools broad while examining the more specific variations of each tool. As Auckland moves closer to implementation, there may be differences in the final policy selected due to this different process.

Assessing Public Engagement

A key part of ensuring there is an equitable and successful CP system is meaningful community involvement. Additionally, getting voters on board is usually an imperative, given that most cities require direct voter approval to move forward new taxes or fees. Generating this groundswell of support is a significant challenge. There appear to be two broad schools of thought for cities: some cities start developing their CP plans with substantial public input and outreach (bottom-up approach); other cities start with the development of a plan and indicate the need for public outreach going forward (top-down). While all cities acknowledge that public outreach and support is critical to a successful implementation, the position public engagement is given on the policy design timeline is telling.

Vancouver is one of the cities that started with public engagement first. Vancouver conducted two rounds of polling, online engagement, and workshops with residents and stakeholders. This public engagement was occurring at the same time as the development of the Mobility Pricing Independent Commission (MPIC) report published in 2018, and the results of that engagement helped inform Vancouver's consideration of alternative policy proposals such as the fuel tax [30]. This demonstrates that Vancouver was not only engaging with the public throughout the development of their reports but actively considering the public's input and incorporating it.

San Francisco has similarly engaged the public throughout the policy development process and incorporated resident suggestions into its proposals. The City's development of its current report has included creative outreach such as interactive games that mimic the decision-making process on CP system specifics. San Francisco also allowed residents to assess the tradeoffs inherent in allowing more discounts, or generating more revenue [6]. When the City first endeavored to study CP, they similarly leveraged a public engagement effort that evaluated policy scenarios based on community input and perceived fairness. This indicates San Francisco has long been focused on public perception of a CP system.

Los Angeles also appears to be paying particular attention to residents, though this may need to be revised as LA Metro releases more details about their plan. While LA Metro's research into CP systems is just beginning, SCAG's work on Mobility Go Zones involved significant input from the public. In a campaign dubbed 100 Hours, stakeholder meetings, focus groups, and social media campaigns were used to solicit feedback on various policy proposals [17]. These suggestions were taken into account in the development of the final pilot areas, demonstrating the importance given to these discussions.

Seattle has not yet engaged extensively with the public. However, this is more of a statement on the progress they have made than on the process they will be implementing. Seattle's report has made it clear they plan to engage the public throughout the policy development stage. While they indicate a plan to engage the public throughout, much of the report is focused on how the plan will be communicated to the public, focusing on goal- and solution-driven messaging and the development of clear communications and materials [7]. As

Seattle moves forward, how and when it engages with the public will determine to what extent they are incorporating public feedback in the development and implementation of a CP system.

While the above cities started with public engagement, others appear to be starting with the development of a plan, then discussing how they will sell that plan to the public. While this could still involve adjustments to any final plan based on that engagement, for these cities the focus seems to be on increasing awareness and support for any plan that is developed. While Boston's CP system development is still in its infancy, the Report on Congestion did not discuss public interest or engagement [29]. This report's goal was never to develop a specific CP plan, so it is understandable why there was no discussion with the public on what a potential plan could look like or what residents might think. While New York is much further along than Boston, it has yet to release reports including discussions of significant public engagement over the development of the plan. Instead, a formal 60-day public engagement and information campaign period has been mandated by the bill before the CP system can be implemented [26]. This means the public engagement will be wholly focused on education and building support rather than including public comments on the policy's design.

Auckland has had extensive public outreach campaigns while developing its CP feasibility studies, but much of this outreach has been focused on how to best frame the policy. This includes suggesting complementary policies to increase support as well as a phased rollout to ensure less public whiplash. Furthermore, the engagement that did occur in the development of the proposed plans themselves mainly involved stakeholders and leaders in the field rather than the general public. While the Technical Question reports suggest extensive public outreach campaigns, these campaigns appear to be mainly focused building support and understanding rather than building the policy itself, a departure from the development observed in Vancouver and San Francisco.

While all cities included in the study have indicated the need for extensive public engagement, they differ in when and how they see that engagement being of use. Some cities, such as San Francisco and Vancouver, seem intent on incorporating public feedback in the development of the plan; others, such as Auckland and New York, appear more focused on increasing public approval and understanding through public media campaigns after the development of a specific policy proposal. Whether these different processes lead to noticeably different final CP systems is unclear, as is how the different approaches will impact public approval for the plan.

Assessing Environmental Considerations

Beyond the process and progress of each city's research into CP systems, there are clear differences in the importance each city ascribes to different aspects of a CP system. Nearly every city acknowledges that a successful CP system will lead to a reduction in VMT and therefore a reduction in emissions. In the analysis of each potential CP system, some measurement of emissions is considered by each city. However, there are still differences in the importance each city has given environmental considerations in the development of their CP plans. How important each city views emissions reductions in the context of a CP system has clear implications for the type of policy that is ultimately implemented. Perhaps the clearest example of this would be the decision to offer an exemption for low or zero emission vehicles. Several studies acknowledge that including an exemption of this type would reduce the effectiveness of a CP system in reducing congestion, especially as more vehicles become greener over time. Whether a city decides to implement this kind of exemption will depend on how important reducing congestion is relative to reducing emissions.

As mentioned earlier, Seattle is one of the cities where environmental considerations loom large for any potential CP system. In Seattle's congestion pricing study, four goals are laid out as the principle areas of focus of a CP system: equity, improvement to the climate and public health, reduction of congestion, and feasibility. While all cities identify equity, ease of implementation, and congestion reduction as primary goals of their CP systems, Seattle is one of the few that marks climate and health as equally important. This importance is borne out when the options examined are considered, with Seattle the only city in this study to consider a fossil fuel free zone (FFFZ) as part of their congestion studies. Seattle goes further by linking air quality to equity, increasing its importance by considering environmental impacts not only explicitly when considering emissions reductions but also considering it during discussions of equity impacts. In this vein, Seattle's report mentions encouraging clean air vehicles through a credit for drivers as a potential equity strategy, one of the few studies that considers the option at all. While no definitive decision is suggested by the report, it is much more likely that Seattle will implement a CP system with exemptions related to low- or zero-emissions vehicles [7].

San Francisco is another city that appears to assign significant importance to environmental considerations. While a final report on the current research on a potential CP system in San Francisco is still forthcoming, San Francisco, similar to Seattle, labeled cleaning the air as one of the 4 key goals of a potential CP system, but unlike Milan, they are not considering exemptions for ZEVs [6].

Similar to San Francisco and Seattle, Los Angeles has also indicated that any CP system implemented in the city would prioritize reducing emissions. But there are two studies (by SCAG and LA Metro) examining CP systems in the Los Angeles region and they approach the topic differently. The SCAG report on Go Zones is a broader study of transportation innovations. Since many transportation innovations reduce emissions, it is not surprising that this report considers these reductions as a critical aspect of the plan [17]. This is difficult to compare to the CP studies from other locations because of the broader nature of the plan, however emissions reduction is considered similarly important as congestion reduction in the final report. Similarly, the yet-to-be

released LA Metro study considers emissions reductions as a goal. However, whether the final study will treat emissions as a secondary effect or primary goal are not yet formalized.

Other cities where the importance of emissions reductions is unclear are New York and Boston. Much of New York City's CP system has been decided, but the full range of exemptions offered is still to be determined. The Regional Plan Association of New York cited reducing emissions as critical, however the group determining the exemptions has not yet indicated whether zero-emission vehicles will be exempt [31]. Boston is similarly unclear on the importance environmental considerations, but Boston is at a much earlier stage in developing a CP system and has not released as much information on the process yet.

Unlike Seattle and other cities that are prioritizing reducing emissions in their CP studies and plans, Vancouver is focusing on reducing congestion. This is not a statement on the relative importance of emissions reductions overall to Vancouver but rather whether emissions reduction is a critical part of developing and evaluating a CP system. The TransLink's MPIC report acknowledges that any CP policy should not detract from their Integrated Air Quality and Greenhouse Gas Management Plan, but it does not discuss reducing emissions as a key goal on par with reducing congestion. Like other cities' reports, the MPIC report does include emissions projections for the various CP proposals, however these projections are not critical to the evaluation of how well each plan performs [30].

Auckland is another city focusing on traffic, not emissions reductions as their core target for a CP system. Though their technical report on the Congestion Question Study does list improving environmental outcomes as part of one of the 12 policy principles the system should uphold, it is given less importance than in Seattle. Similar to Vancouver, emissions projections are included in the evaluation of various CP options, however they find little variation between the different systems considered and do not reject any systems based on their environmental impact. Furthermore, the discussion of environmental improvements as only a part of one of the 12 principles for the CP system to follow, indicating the relative lack of importance assigned to emissions reductions in evaluation of CP options [11].

None of the cities discussed above has confirmed or rejected exemptions for clean vehicles and thus it is difficult to draw definitive conclusions regarding how important emissions are for each city's CP evaluations. However, based on the reports that have been released, cities differ in how central emissions reductions are to their evaluation of potential CP plans. Based on this importance, Seattle is more likely to implement an exemption for low- or zero-emissions vehicles than Vancouver is. If these cities do differ once a CP system is implemented, they can be evaluated on how well the CP policy chosen reduced emissions alongside reducing congestion.

Conclusion

Each of the cities discussed in this report have considered or are considering a CP system. While all these cities believe that a CP policy may be effective at reducing congestion, their approaches and set of goals vary significantly, as does their progress towards implementation. New York and Auckland appear relatively close to implementation; Vancouver, San Francisco, and Seattle are well into the process; and Boston and Los Angeles are early in the process.

Furthermore, which levels of government are working on the system varies, with those closer to implementation appearing to have much stronger partnerships between the municipal level and the regional, state, or national level. Similarly, most of the cities start considering a range of options before narrowing down to comparing more detailed CP systems. Auckland is the exception, considering a wide range of detailed possibilities. The cities also differ in the level of detail of their research in different areas, such as equity and environment, and in their timing and emphasis on public engagement and perception. Vancouver and San Francisco have made public engagement a cornerstone of their plan development, using polls and workshops to finetune the details of their CP proposals. In contrast, Auckland, while still engaging with stakeholders and experts for guidance, has mainly focused on how to ensure public support and understanding of the proposals they recommend.

How these different approaches will shape public approval and the policy's success should inform future understanding of how to best engage the public. CP policies are, as indicated by the name, principally intended to reduce congestion. While every city in this study is concerned with congestion, some see this policy as also serving to reduce emissions. Every city acknowledges that reducing congestion should lead to reduced emissions, however Seattle more than the others considers emissions reductions as important as reducing congestion. This may lead to a final CP policy with more exemptions or with features that differ significantly from most of the other cities examined, which see emissions reductions as a happy byproduct rather than a principal aim of any CP system. Finally, some cities have focused on discounts as a primary strategy to achieve equity, while others have taken a wider approach. Seattle has perhaps the broadest research agenda, considering multiple equity strategies with a strong interest in emissions reductions.

Considering a wide range of CP options does not necessarily include a wide range of equity strategies. For example, Auckland is one of the cities that acknowledges that strategies other than discounts are effective and perhaps preferred to a lengthy exemption list. While there are no clear groups of cities that match across each of the topics we examined, the range of approaches will provide insight for cities developing CP systems in the future. For example, those that are able to quickly and effectively implement CP systems will provide a blueprint for new cities. The cities included in this study are all on their way to implementing a CP system, and the differences across the duration of their CP activities, the range of options considered, public engagement, environmental considerations, and equity considerations provide lessons for future cities.

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